

CA2 ALOG
R23
1964

ALBERTA LEGISLATURE LIBRARY



3 3398 00437 3170

OGCB REPORT 65-2

*Shelburne Energy
Resource Conservation Bd*

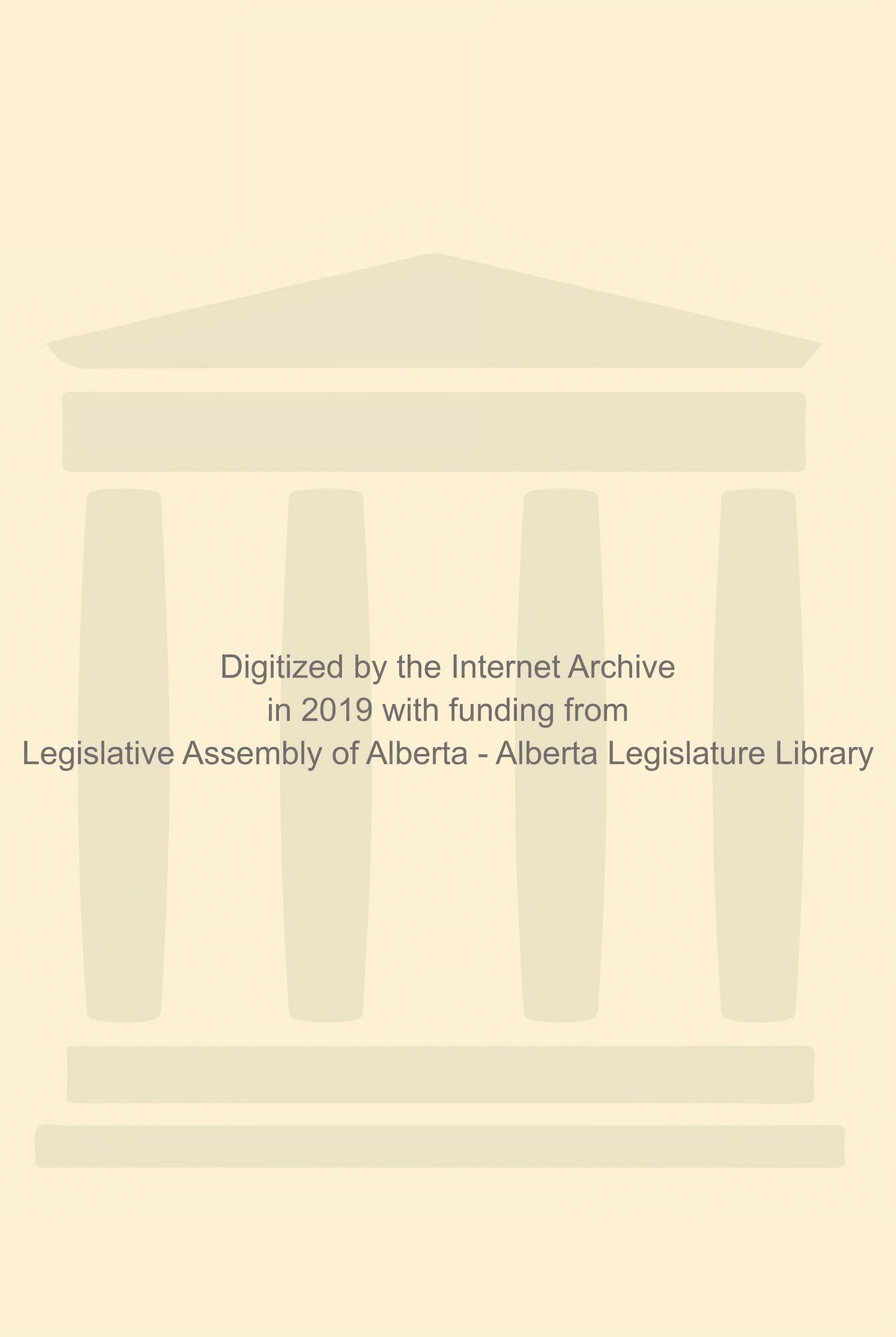
REPORT OF THE OPERATIONS OF THE OIL AND GAS CONSERVATION BOARD

1964

OIL AND GAS CONSERVATION BOARD

603 SIXTH AVENUE SOUTH WEST • CALGARY, ALBERTA

SEP 19 2017
PROVINCIAL LIBRARY
VICTORIA, B. C.
EDMONTON



Digitized by the Internet Archive
in 2019 with funding from
Legislative Assembly of Alberta - Alberta Legislature Library

PREFACE

The Board issued its first "Report of Operations" in April, 1964 covering its operations during the calendar year 1963. The

REPORT OF THE OPERATIONS OF THE OIL AND GAS CONSERVATION BOARD

report prepared for the purpose of informing members of the Legislative Assembly of Alberta, the oil and gas industry and the public at large with the responsibilities, organisation and activities of the Board. Since the report appears to have been well received the Board has decided to make it an annual publication.

1964

The present report is introduced with a brief discussion of the general activities of the oil and gas industry in 1964, emphasis being placed on those related to conservation. Following this is a summary of the constitution, responsibilities and functions of the Board; a discussion of its organization and staff; and a general summary of important statutory changes affecting the Board and policy changes made by the Board during 1964. The main section of the report deals with the responsibilities, organization and activities of the several staff departments of the Board and discusses the role of each in the discharge of the overall responsibilities of the Board. Following this is a statement of Board expenditures and revenues, comparing them with previous years and with indices of industry (and Board) activity. Finally a brief section describes the publications of the Board and lists technical and other papers and addresses prepared or given by members of the Board and its staff.

OIL AND GAS CONSERVATION BOARD

603 SIXTH AVENUE SOUTH WEST • CALGARY, ALBERTA

February 25, 1965

Chairman

PREFACE

The Board issued its first "Report of Operations" in April, 1964 covering its operations during the calendar year 1963. The report was prepared for the purpose of further acquainting members of the Legislative Assembly of Alberta, the oil and gas industry and the public at large with the responsibilities, organization and activities of the Board. Since the report appears to have been well received the Board has decided to make it an annual publication.

The present report is introduced with a brief discussion of the general activities of the oil and gas industry in 1964, emphasis being placed on those related to conservation. Following this is a summary of the constitution, responsibilities and functions of the Board; a discussion of its organization and staff; and a general summary of important statutory changes affecting the Board and policy changes made by the Board during 1964. The main section of the report deals with the responsibilities, organization and activities of the several staff departments of the Board and discusses the role of each in the discharge of the overall responsibilities of the Board. Following this is a statement of Board expenditures and revenues, comparing them with previous years and with indices of industry (and Board) activity. Finally a brief section describes the publications of the Board and lists technical and other papers and addresses prepared or given by members of the Board and its staff.

February 25, 1965

G. W. Govier
Chairman

CONTENTS

	<u>PAGE</u>
Preface	
I The Alberta Oil and Gas Industry in 1964	1
II Responsibilities and Functions of the Board	10
III Organization and Staff	13
IV Statutory and Policy Changes	18
V Duties, Organization and Major Activities of Board Departments	22
A Development Department	23
B Oil Department	32
C Gas Department	37
D Geology Department	41
E Special Studies and Programming Department	46
F Chemical Laboratory	49
G Economic Studies Department	51
H Accounting Department	52
I Administrative Services Department	57
VI Expenditure and Revenue	63
VII Publications and Addresses	68

I THE ALBERTA OIL AND GAS INDUSTRY IN 1964

Exploration

On January 1, 1964, the Board adopted the Lahee system of well classification for all new wells and during 1964 reclassified its historical data to comply with the Lahee system. Thus, the data for number of wells and the corresponding footage drilled is not directly comparable with the statistics shown in the 1963 Annual Report. For the purpose of this report, 1964 data is compared with reclassified 1963 data.

The trend of increasing activity in the exploration phase of the industry continued in 1964. Based on the Lahee well classification system the proportion of total drilling activity devoted to exploration increased slightly in 1964 to 40 per cent of wells drilled from some 37 per cent during 1963. There were 742 wildcat wells drilled in 1964, almost 21 per cent more than the prior year. A similar degree of success to that in 1963 was experienced in 1964, with some 27 per cent of wildcat wells drilled finding commercial oil or gas.

Exploratory footage drilled increased in 1964 compared with the prior year but to a somewhat lesser degree than the number of wells. The result was that the average depth of wildcat wells drilled in 1964 decreased to 5,237 feet from 5,842 feet in 1963.

Exploration was concentrated in three main areas: in the northern part of the Province from the Snipe Lake area to the Sylvia-Mitsue-Hondo area; in the Pembina and Edson areas

in central Alberta and in the Taber-Bantry-Brooks area in the southern part of the Province. The highest level of activity recently has occurred in northern Alberta following oil discoveries in the Sylvia-Mitsue-Hondo area.

Development

The number of development wells drilled in 1964 increased to 1,098 from 1,058 drilled in 1963. However, this difference resulted from an increase in the number of dry holes, rather than a greater number of successful oil and gas wells, which, at totals of 747 and 125 respectively, were actually less than in 1963.

Development footage drilled increased by some four per cent during 1964, to 6,454,366 feet compared with the 6,225,633 feet drilled during the prior year. The proportionate increase was fractionally lower than that of wells drilled, resulting in a slightly lower average well depth, 5,878 feet compared with 5,884 feet for 1963.

The main oil development drilling occurred in the Swan Hills, Deer Mountain, Snipe Lake, Medicine River, Kaybob South and Pembina Fields and the Taber-Bantry area, while that for gas took place in the Medicine Hat, Countess, Wayne-Rosedale and Provost Fields.

Reserves

The Board staff estimates that during 1964, virgin reserves of crude oil increased by some 575 million barrels, and after production, added 400 million barrels to remaining recoverable

reserves. The latter increased from 3,810* million barrels in 1963 to 4,210 million barrels in 1964. This reserve total is preliminary and subject to adjustment following a hearing to be held on February 23, 1965, at which the operators will present their estimates of reserves in certain pools.

New discoveries were responsible for only small additions to crude oil reserves, which is to be expected having regard to the lack of appreciation due to further drilling. One of the 1964 discoveries was clearly significant: production from the Gilwood sand in the Sylvia-Mitsue-Hondo area is the first from this strata in the Province and has spurred the search for other such pools in this general area. The Sylvia-Mitsue-Hondo discovery itself has not been developed to the extent where its reserves may be adequately estimated. Other discoveries, which on the basis of current development appear relatively small, were made at Calais, Edson area, Giroux, Sarah East and Simonette. Reserve appreciation in older pools due to enhanced recovery operations and field extensions contributed the major part of reserve additions.

Reserves of oil in place in the oil sands of Northern Alberta were estimated in 1963 at 711 billion barrels, with close to 90 per cent being in the Athabasca area. The volume of up-graded synthetic crude oil recoverable from the oil sands was estimated to be some 300 billion barrels. No further studies of these reserves were made in 1964.

* All data in the 1963 Annual Report were estimated, whereas the 1963 figures shown here are actual. Estimated 1963 reserves of crude oil were 3,787 million barrels.

According to Board staff estimates, virgin reserves of marketable natural gas increased by about 3.5 trillion cubic feet in 1964, which, after production, increased remaining reserves from the 1963 level of 32.9 trillion cubic feet to an estimated 35.7 trillion cubic feet. Similarly to oil, and as is to be expected, the reserve additions were due almost entirely to appreciation of previously discovered reserves.

Reserves of natural gas liquids at the end of 1964 were estimated at some 950 million barrels, an increase of about 5 per cent over the 1963 level. Pentanes plus represented an estimated 530 million barrels compared with 492 million barrels for the prior year. Estimated reserves of propane and butanes increased slightly to some 420 million barrels.

Productive Capacity

Productive capacity of crude oil increased from an average of 986,000 barrels per day in 1963 to 1,089,000 barrels per day in 1964, an increase of 10.4 per cent. This growth was largely a consequence of improved recovery due to pressure maintenance and to extensions of existing fields.

The expansion in capacity to produce has been significantly greater than the growth in production over the year. The result was a decline in average per cent utilization of productive capacity from the 47 per cent of 1963 to 44 per cent in 1964.

Production and Markets

Production of crude oil in 1964 averaged 479,000 barrels

per day, an increase of 4 per cent over the prior year. Pentanes plus production increased by almost 16 per cent in 1964, to 66,000 barrels per day, of which about 2,000 barrels per day was condensate and 64,000 barrels per day was production from gas processing, conservation and cycling plants.

Alberta's share of the total Canadian market for domestic crude oil and pentanes plus of 536,000 barrels per day, which was 61 per cent in 1963 decreased to 60 per cent or 323,000 barrels per day in 1964. Exports from Alberta to the United States increased by almost 10 per cent, from 202,000 barrels per day in 1963 to 222,000 barrels per day in 1964.

Production of raw natural gas increased from 1963 by some 16 per cent, to 1,185 billion cubic feet, of which an estimated 741 billion cubic feet was marketed. Of the 444 billion cubic feet of gas produced and not marketed, 191 billion cubic feet was stored or re-injected, 101 billion represented processing shrinkage, while plant fuel and unavoidable waste accounted for the remainder.

Production of propane and butanes increased by about 90 per cent in 1964 over the prior year to 31,500 barrels per day. Sulphur production expanded by some 15 per cent to 1,413,154 long tons. These increases are largely the result of the expansion in output of natural gas, but also reflect production from a new plant at Empress, which came on stream in April 1964. Developments in offshore markets increased the demand for sulphur by 45 per cent, to 1,519,396 long tons, and the difference between production and demand resulted

in a fall in inventories of some 11 per cent.

Conservation Activity

Developments in Oil

Of major importance was the publication by the Board of a new plan for the prorating of light and medium crude oil to market demand, in OGCB Report 64-10. The new plan will allocate production among pools on the basis of reserves, and within pools on the basis of area modified by recovery factor. The plan also provides for the formation of production spacing units, which will permit, subject to certain rules, the production by a single well of the allowables previously applicable to more than one well. In the past, the basis of allocation was an economic allowance for each well and productivity as indicated by well and pool MPR's. The new plan provides a minimum allowance which would apply only where a well's allocation according to the formula, is below the minimum level. A five year transition period has been allowed to enable operators to adjust gradually to the new plan, which will become fully effective during 1969.

Recovery enhancement schemes have continued to assume major importance in terms of expanding the Province's crude oil reserves. As a result of water injection schemes which were initiated during the year, estimates of remaining recoverable reserves in a number of pools are expected to about double the previous estimates based on natural depletion. The pools affected are the Judy Creek West, Snipe Lake, Deer Mountain, Carson Creek North, Swan Hills Beaverhill Lake, and portions

of the Pembina Cardium pool. Of particular interest in enhanced recovery operation was the initiation of a miscible flood scheme in the Golden Spike South D-3 A pool which is expected to lead to the ultimate recovery of some 85 per cent of oil-in-place. There are now 214 enhanced recovery projects in operation in 27 fields of the Province.

The economic prospects of heavy oil production in the Bantry and Taber areas have been enhanced by a pipe line connection, completed during November, 1964, to the Interprovincial line. Intensified drilling, possibly induced in part by the improved transportation to market, has led to a number of small but interesting discoveries in south-eastern Alberta.

Developments in Gas

Of major interest in 1964 were the hearings of applications by Trans-Canada Pipe Lines Limited and by Alberta and Southern Gas Co. Ltd., for increased removal of gas from the Province. Relative to these applications, the Board made a detailed review of gas reserves and deliverability for Alberta, complementing a Board study of future demand for gas in the Province. The Board, with the consent of the Lieutenant Governor in Council, approved the applications in November, 1964, in OGCB Report 64-11. The authorized withdrawals from the Province were increased to 12,080 billion cubic feet for Trans-Canada and to 6,450 billion cubic feet for Alberta and Southern.

There was in addition to the above hearings of applications

by The British American Oil Company Limited and Provo Gas Producers Limited, for the removal of small amounts of gas from the Province. The Board, with the consent of the Lieutenant Governor in Council, approved these applications in 1964, permitting the withdrawal from the Province of 65 billion cubic feet from the Antelope, Esther and Wildunn Creek Fields.

Approvals were issued for five gas plants capable of processing a total of 98 million cubic feet of gas per day and for a small recycling scheme in the Carstairs Elkton A Pool.

Government Revenues

Government revenues from the disposition of oil and gas rights increased by almost 35 per cent in 1964, being \$188,445,221 from all sources compared with the \$139,578,716 of 1963. Of the three sources of revenue to the Province, crown reserve sales, rentals and royalties, crown reserve sales registered the greatest increase of over 82 per cent from \$46,647,386 in 1963 to \$84,820,152 in 1964. Royalty payments increased by some 10 per cent to \$60,853,793 from \$55,138,891 while rental payments increased from \$37,792,439 in 1963 to \$42,771,276 in 1964.

The total government revenue per barrel of equivalent crude oil production - all products being converted on a market value basis to the equivalent number of barrels of crude oil - was 73 cents or 29 per cent of the gross value per barrel.

Of this figure, 33 cents was attributable to Crown Reserves Sales, 23 cents to royalty payments and 17 cents to rental payments. Comparable figures in 1963 on a total basis were 60 cents and 24 per cent, and split between the three categories of government revenue, 20 cents, 24 cents and 16 cents respectively.

Industry Revenues

Revenues to the oil and gas industry from production in Alberta during 1964 totalled \$652,368,688 an increase of about 10 per cent over the prior year total of \$592,196,120. The greatest proportional gain was to sulphur, sales of which returned \$16,806,139 to producers. This represented a 39 per cent increase over 1963, which, when compared with the production increase of 15 per cent, reflects increased markets and a strengthening in prices for Alberta sulphur. Gas, propane and butanes sales in total recorded gains of some 20 per cent, the former being \$113,192,889, a 17 per cent rise and the latter two totalling \$11,838,781, or 52 per cent more than 1963. A 7 per cent increase in the value of sales of crude oil and pentanes plus, from \$475,756,832 in 1963 to \$510,530,879 in 1964, when compared with the crude oil production increase of only 4 per cent, reflects the increasing importance of pentanes plus in the oil market.

II RESPONSIBILITIES AND FUNCTIONS OF THE BOARD

The Board is established by The Oil and Gas Conservation Act for the purpose of administering that Act. It is also charged with the administration of The Gas Resources Preservation Act, 1956, and The Turner Valley Unit Operations Act. Additionally, it may be called upon to supply information and advice to the Department of Mines and Minerals, particularly in connection with applications for permits under The Pipe Line Act, 1958. Finally, the Board, like the Public Utilities Board, may refer applications that touch on matters in part within the purview of each of the Boards to the Gas Utilities Board, of which the Chairman of the Oil and Gas Conservation Board is a member and to which the Board gives technical and other assistance in connection with applications referred by it.

The purposes of The Oil and Gas Conservation Act are to effect the conservation of the oil and gas resources of the Province and to prevent their waste, to secure the observance of safe and efficient field practices and to afford each owner the opportunity of obtaining his share of the production of any pool. The Board must see that, in the light of sound engineering and economic principles, oil field operations are so conducted that wells are properly located, spaced, drilled, equipped and produced so that the recovery of oil or gas from a pool is not lessened and reservoir energy is not improperly dissipated, that recovery enhancement techniques are used where suitable, that economic waste of gas is prevented, that

proper storage facilities are used, and that oil or gas is not produced in excess of storage and transportation facilities or the demand for such products.

To carry out these functions the Board employs the appropriate personnel including engineers, geologists and others. It maintains a head office in Calgary and field offices in major oil and gas areas. The Board issues regulations and orders pertaining to drilling and producing operations; considers applications by operators; has its staff conduct inspections and make studies; and collects, summarizes and publishes various data.

Under The Oil and Gas Conservation Act, the Board also is charged with the examination of schemes, either of an experimental or commercial character, of obtaining production from oil sands. The Board also, under Part VII of the Act, assesses and taxes oil and gas properties to obtain a revenue to cover a portion of its expenses under the Act. The carrying out of its duties and responsibilities under this Act and other Acts requires the Board to conduct investigations, hold hearings and prepare reports.

The Turner Valley Unit Operations Act empowers the Board, upon application, to order a part of the Turner Valley Rundle Pool to be operated as a unit. Under this Act, four oil productive and one gas productive units have been established, encompassing substantially all of the Turner Valley Field.

The purpose of The Gas Resources Preservation Act, 1956, is to provide for the effective utilization of the gas resources

of the Province, having regard to the present and future needs of persons within the Province. For this purpose the Board must from time to time determine the volumes of established reserves of gas in the Province and the trends in growth and discovery of gas reserves and the present and future needs for gas within the Province. Applications for permits for the removal of gas from the Province are considered in the light of such determinations and may be granted if it is in the public interest to do so.

III ORGANIZATION AND STAFF

The Board consists of three members, including a Chairman and Deputy Chairman, appointed by the Lieutenant Governor in Council. The members are appointed for a five year term and thereafter during the pleasure of the Lieutenant Governor in Council.

For the most part of the year the Board operated with a Senior Advisory Group consisting of the Administrator for Gas, the Administrator for Oil and the Board Solicitor. In October Mr. J. G. Stabback, Administrator for Gas, resigned his position to accept the post of Chief Engineer for the National Energy Board. Following this the Board made a number of changes in its organization. These changes involved the elimination of the positions of Administrator for Gas and Administrator for Oil with the duties of the positions being transferred in part to a newly created position of Chief Engineer and partly to the Heads of the Oil and Gas Departments whose titles, along with that of the Head of the Development Department, were changed to Manager. Mr. N. A. Macleod, Board Solicitor and Mr. D. R. Craig, appointed Chief Engineer on November 1, 1964, serve as the Senior Advisory Group providing legal and technical advice directly to the Board. An Applications Advisory Group under the Chairmanship of the Chief Engineer and including the Board Solicitor and the Managers of the Gas, Oil and Development Departments advises the Board on routine applications.

The chart presented in Figure 1 indicates the overall organization of the Board showing its various departments. The departments vary in size, ranging from 74 employees in the Development Department to three in the Personnel Department. Each Department Head is responsible to the Board for carrying out the functions assigned to his department as summarized in Section V of this report. In addition to the normal departmental responsibilities the Managers of the Oil Department, the Gas Department and the Development Department serve as members of the Applications Advisory Group, and along with other senior staff act as examiners at hearings.

The Board maintains seven field offices that are staffed by engineers and technicians whose basic responsibility is to observe oil and gas field operations. Field offices are located at Camrose, Drayton Valley, Redwater and Devon in the Northern district and Red Deer, Black Diamond and Medicine Hat in the Southern district. The Engineer in charge of each field office is responsible to the appropriate district engineer who, in turn, is responsible to the Manager of the Development Department. The Board is proceeding with a consolidation of its field offices in order to reduce expenditures and improve efficiency. In 1964 the Stettler office was closed and the major portion of its responsibility was transferred to the Red Deer office. The second step will be made in 1965 when the offices in Redwater, Devon and Camrose will be consolidated in a new office in Edmonton.

A general statement regarding the division of Board responsibilities would specify that the Development Department is responsible for the drilling and production practice phase of industry regulation, and the Oil and the Gas Departments are responsible for ensuring maximum conservation from oil and gas pools as discovered and developed. The Gas Department is additionally responsible for assisting the Board in controlling the volumes of gas removed from the Province. The Geology and the Special Studies and Programming Departments and the Chemical Laboratory provide technical assistance to the three main engineering departments. The Economic Studies Department and the Production Accounting division of the Accounting Department provide economic and statistical data and assistance. The Economic Studies Department also administers the oil proration plan with the assistance of the Oil Department. The Administrative Services Departments and the Financial Accounting division perform services for the Board organization as a whole.

The Board had an approved staff complement of 251 employees at year-end. This represents an increase of three during the year. A total of 187 were located in Calgary, 56 in the Board's field offices and eight in Edmonton.

During the year a comprehensive development program was continued in an effort to maintain a high standard of competence in the engineer-geologist group which makes up approximately one-third of the Board's staff. Internal courses were conducted and additional steps were taken to improve the

utilization of engineers and geologists, by transferring routine duties to engineering assistants.

In the last two years courses for engineering assistants and field technicians have been conducted. A substantial number of technical and supervisory personnel have made a conscientious effort to improve their job competence by attending external courses. The Board encourages employees to increase their job knowledge by paying one-half the tuition upon successful completion of job-related courses.

The staff turnover during the past year amounted to 71 employees or 29 per cent of the total Board complement. This can be compared with a turnover of 24 per cent in 1963 and 20 per cent in 1962. An analysis of the 1964 turnover indicates that 15 of the 71 employees resigned for reasons other than those associated with Board employment and a further 31 represented resignations by female employees. The remaining turnover is largely related to the technical classifications, including Engineers, Geologists and Engineering Assistants and is indicative of the strong industry demand for such personnel.

OIL AND GAS CONSERVATION BOARD BOARD ORGANIZATION

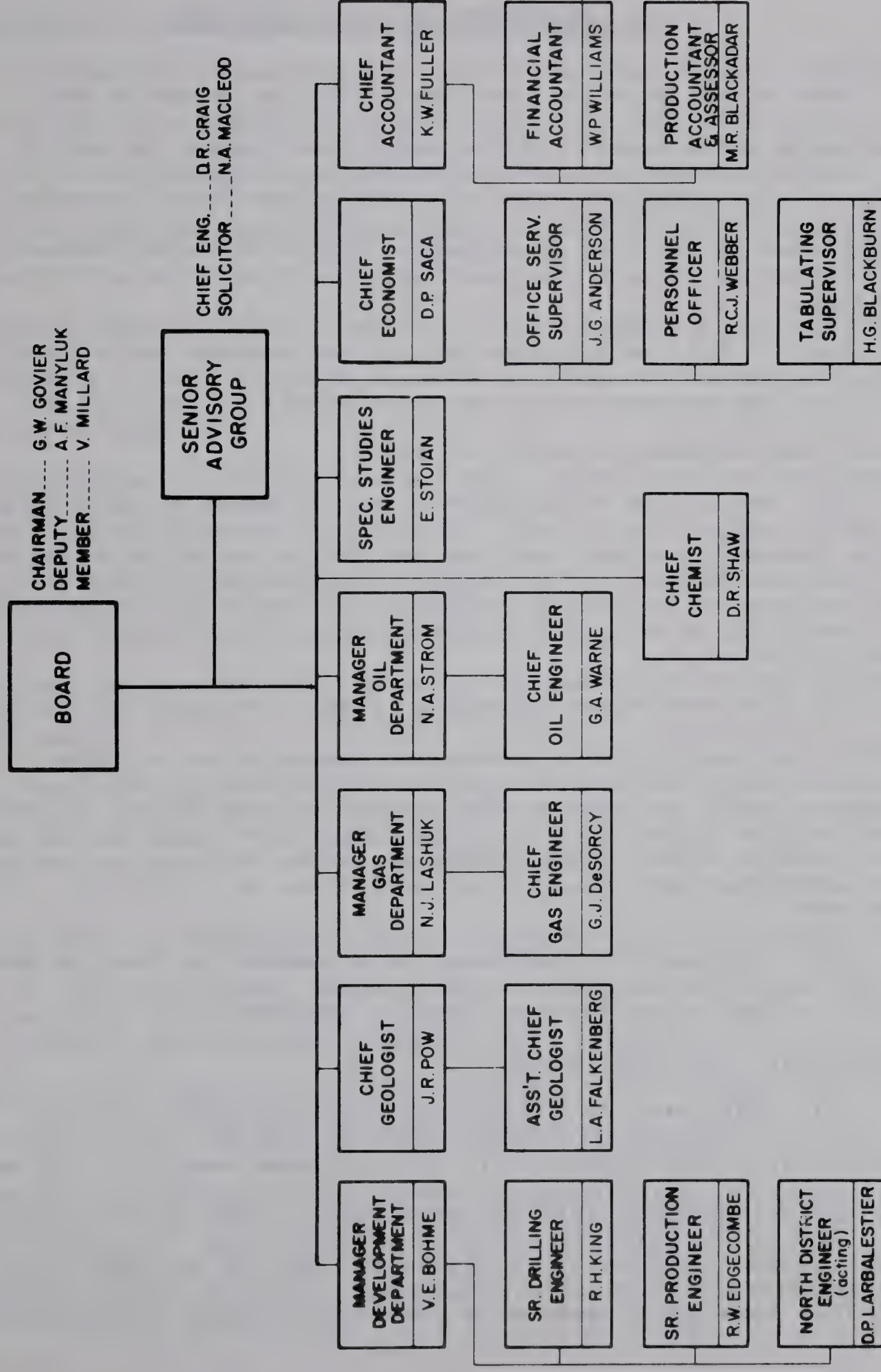


FIGURE 1

IV STATUTORY AND POLICY CHANGES

Most of the year 1964 was one of little change in the enactments administered by the Board, but toward the end of the year this stability came to an end as the Board prepared to implement a new plan of proration of oil to market demand.

Statutes

The Oil and Gas Conservation Act was amended as follows:

(1) The maximum amount at which a well licence fee may be set was increased from \$50 to \$60.

(2) Section 20 outlining data to accompany an application for a licence for a well drilled for oil or gas or an injection well was amended to reduce the number of copies of survey from three to two.

(3) The provisions regarding common purchasers of gas were amended to specify that a person designated to be a common purchaser would not have to buy greater volumes or buy at greater rates than he would if the common purchaser declaration had not been made.

(4) The taxation provisions were amended so that the Board would not levy a tax where an owner's property in an area is assessed at less than \$3,000.

(5) Under section 133 the minimum fine that could be levied against one found guilty of an offense under the Act was \$100 and by amendment this was increased to \$300 in the case of a corporation and reduced to \$50 in the case of an individual.

(6) Some minor amendments for clarification were also made.

Regulations

Following the amendment of The Oil and Gas Conservation Act the well licence fee was raised by Order in Council from \$50 to \$55. The increase was necessitated by the expense to the Board of operating the enlarged Core Storage Center. However, later in the year the Provincial Government undertook to bear a greater share of this expense, and in December a further Order in Council reduced the well licence fee from \$55 to \$50 effective January 1, 1965.

The Rules of Practice of the Oil and Gas Conservation Board, which came into effect on January 1, 1964, were amended in May, 1964, to specify the number of copies of an application that must be filed as seven and the number of copies of an intervention that must be filed as seven to the Board and one to the applicant.

The Drilling and Production Regulations were amended three times in the year. The first amendment, by Alberta Regulation 175/64, clarified the multi-zone provisions. The second amending order, Alberta Regulation 502/64, amended section 43, subsection (5) of the regulations, dealing with the placing of flame type and electric element type equipment near a well, to make the provision not applicable in the case of a water supply or water injection well, and also replaced section 58 dealing with the release of data from records, reports and information filed with the Board. The new section 58 consolidated the former provisions and also contained some new provisions particularly

with respect to data concerning or obtained from experimental schemes. The last 1964 change to the Drilling and Production Regulations, being Alberta Regulation 629/64, effective May 1, 1965, provided changes in the wording of several sections of the regulations which would be needed when the transition of the new plan of proration of oil to market demand commences.

The General Regulations under The Oil and Gas Conservation Act were amended by Alberta Regulations 165/64 and 567/64. The first order was one that resulted from the work of the Conservation Board Review Committee and provided a complete rewriting of the provisions regarding the metering and measurement of gas, oil and water. The second amendment contained provisions which will be effective May 1, 1965, and which will provide for the establishment of production spacing units and blocks and for their use when transition to the new plan of proration of oil to market demand commences. This last order also contained the following provisions effective immediately:

(1) The definition of a gallon was amended so that it is equated to 34.9723 gallons instead of 35 gallons.

(2) A reference in section 109e was corrected.

(3) The provisions regarding overproduction were clarified and slightly amended to make the application of them more practical.

(4) Schedule D of the First Schedule to the regulations was struck out. This schedule at one time was used in connection with the allowables of certain wells producing both oil and gas.

Major Changes in Policy

In July, 1964, the Board announced a new plan for the proration of oil to market demand in Alberta (set forth in OGCB Report 64-10). Transition from the old to new plan will start on May 1, 1965, and will be complete on May 1, 1969.

V DUTIES, ORGANIZATION AND MAJOR ACTIVITIES OF
BOARD DEPARTMENTS

This section of the report deals with the make-up and principal activities of the nine Board Departments. The technical departments are described first.

Before presenting the departmental activities, it is probably worthwhile to mention the overall activity relative to the consideration of registered applications. During 1964 the Board received some 470 applications of the type which it registers individually. This volume is slightly higher than prevailed in the previous year. Such applications are those which, if approved, would result in the issuance of a Board Order, Approval or Permit. They are exclusive of routine applications such as for drilling licences and well allowables which are processed on a day to day basis. Public hearings were held in connection with some 150 of the applications, 15 of them by Board Members and the balance by Examiners appointed by the Board. Approximately 90 of the applications were considered after giving public notice for objections and the balance were of a routine nature and dealt with directly by the Board and its staff.

Most of the Board Departments are involved with the processing of applications from time to time. In fact, the functions related to applications form a large part of the work load of the Oil and the Gas Departments, the Board Solicitor, and the Reproduction section. Many of the applications require extensive technical analysis and subsequent reports of

recommendation to the Board. The reviews of performance of approved schemes also demand considerable attention from the technical departments of the Board.

Another general activity in 1964 was the participation of the Board and its staff on technical or legal committees of various government and industry organizations. Among the organizations having Board representation were the Provincial Mines Ministers' Conference, including the Interprovincial Petroleum and Natural Gas Committee; the Interstate Oil Compact Commission, industry core storage committee, the Alberta Petroleum Industry Training Service, the Petroleum Technology Course of the Southern Alberta Institute of Technology, the War Supplies Agency of the Department of Defence Production, the Emergency Measures Organization and The Federal Provincial Oil and Gas Statistical Committee.

A DEVELOPMENT DEPARTMENT

The Development Department is responsible for most matters within the Board's jurisdiction concerning the drilling and producing of wells.

Headed by V. E. Bohme, Manager, the Development Department is divided into three main sections; the Drilling Division, under the Senior Drilling Engineer, the Production Division, under the Senior Production Engineer, and the field offices, supervised by the Northern District Engineer and the Southern District Engineer. The responsibilities, functions and organization of each of these is described in more detail below.

(a) Drilling Division

Responsibilities and Functions

This division's main responsibilities are to ensure the proper location of wells, to reduce the possibility of subsurface contamination and blowout hazard by specifying proper procedures for casing, cementing and abandoning wells, and through inspections by the field staff, to ensure that drilling operations are conducted so that the possibility of blowouts occurring are minimized.

The major functions of the division are:

(1) to process applications to drill, suspend, rework plug back or abandon a well; to specify casing, cementing and completion practices; to review directional surveys and set factors for off-target wells;

(2) to appraise and make recommendations to the Board regarding the disposition of applications for special spacing units and target areas, compulsory pooling of spacing units, and relief from penalty for off-target wells;

(3) to maintain files and records respecting unit agreement areas, well licence transfers, amendments, cancellations; well names and changes thereto, and appointment of agents;

(4) to prescribe surface casing depths, casing cementing volumes, casing design, cementing materials and equipment; and

(5) to review drilling rig inspection reports from the Board field staff, and correspond with drilling contractors

regarding the recommendations arising from the rig inspections.

Organization and Staff

The division is both technical and clerical and is headed by the Senior Drilling Engineer who is responsible to the Manager of the Development Department. The complement was changed at the year end with the replacement of an engineer by an experienced Engineering Assistant.

The staff complement comprises the following:

Senior Drilling Engineer, R.H. King	1
Assistant Drilling Engineer	1
Engineering Assistants	3
Stenographer and Typist	<u>2</u>
Total	7

Activities During the Year

Seventy-five special applications to the Board were dealt with by the division as compared to 61 in the previous year. Of this number 60 related to off-target area factors, 5 to compulsory pooling, 2 to suspension of target area and spacing unit regulations, and 8 to establishment of special individual spacing units.

More than 2,050 applications for well drilling licenses were examined and forwarded to the Department of Mines and Minerals for issuance of licences. This is a substantial increase over the previous year total of 1,700.

The program of continuous study of casing and cementing specification and procedure was continued during the

year to cope with new equipment and different problems occurring as new productive areas were developed.

Two blowouts and 3 unrelated fires occurred at drilling sites during the year and were reported to the Division. Two other blowouts occurred at wells from which casing was being salvaged.

(b) Production Division

Responsibilities and Functions

The Production Division's major responsibility is to ensure accurate measurement of produced or injected reservoir fluids, both on a pool-wide and individual well basis. The division is also responsible for such production phases as control of air pollution and physical waste, approval of new types of production equipment, disposal of produced water, approval of multiple-zone completions and control of flow lines which are common to two or more wells upstream from measurement facilities.

The major functions of the division are:

(1) to correlate field staff inspections of measurement practices, well testing procedure and production accounting and correspond with the operators regarding the results of these inspections; to perform periodic audits of company production accounting methods at their major offices;

(2) to deal with requests for exemption from gas measurement for wells or pools;

(3) to appraise applications for water disposal schemes

and recommend disposition of them; to review disposal methods for produced water, and recommend volume restrictions for surface disposal, where necessary; to review field reports regarding air pollution and require operators to take the necessary steps to curb air pollution from production facilities;

(4) to process applications for multiple completions and common flow lines and schedule and evaluate segregation tests on multiple completions; and

(5) to correlate and follow up inspections of producing and abandoned well sites and batteries.

Organization and Staff

The organization of the division is similar to the Drilling Division and is headed by a Senior Production Engineer who is responsible to the Manager of the Development Department. Because several major projects were completed during the year, and measurement problems generally had decreased, it was possible to reduce the staff by two.

The staff complement comprises the following:

Senior Production Engineer, R. W. Edgecombe	1
Production Engineers	2
Engineering Assistants	2
Stenographer	<u>1</u>
Total	6

Activities During the Year

During 1964 the quality of fluid measurement has been maintained at a satisfactory level. The field offices'

meter inspection, production practices and records checking program continues to ensure adequately accurate production figures.

The division assessed applications for 24 new water disposal schemes and recommended the amendment of the approvals for 22 existing schemes. Three new "W" Orders were issued to restrict surface water disposal.

The number of multi-zone completions in the Province was increased by 45 to 306. Semi-annual segregation tests of these wells found 8 cases of commingling, 6 of which were due to faulty equipment.

In cooperation with the Department of Health, efforts were continued to eliminate air pollution by sulphurous gases from production and gas processing facilities. Complaints about air pollution have decreased substantially during the year.

Six inquiries were held during the year for breaches of regulations, including failure to submit correct production returns, incorrect reporting of gas production, pollution of the atmosphere and excess surface disposal of salt water. One prosecution was initiated for failing to submit accurate production returns.

(c) Field Offices

Responsibilities and Functions

The chief responsibility of the field offices is to ensure that The Oil and Gas Conservation Act, the

Regulations pertaining thereto, and the various other requirements of the Board are observed by the industry at the field level. The field offices act as an information gathering medium and in some instances as a liaison body between the landowner and the oil operator.

To carry out these responsibilities, there are a number of separate duties, which together comprise most of the work load of the field offices. The major duties are:

(1) to inspect wells, batteries, measurement equipment and drilling rigs; to witness a representative number of dual completion operations, segregation and back pressure tests;

(2) to carry out sub-surface pressure measurements and calibrate pressure instruments;

(3) to check operators' production practices and reporting procedures and prepare reports on gas plant operations; and

(4) to prepare weekly drilling progress and rework reports.

Organization and Staff

For the purposes of administration, the Province has been divided into two main areas, the Northern District and the Southern District, each headed by a District Engineer who reports to the Manager of the Development Department. The Northern District Engineer supervises field offices located at Devon, Redwater, Drayton Valley and Camrose. Medicine Hat, Red Deer and Black Diamond offices are responsible to the

Southern District Engineer, located in Calgary. During the year, L. A. Bellows, the Northern District Engineer, was granted a two-year leave of absence to return to university and was replaced by P. D. Larbalestier in an acting capacity. At the end of the year the Southern District Engineer, M. R. Blackadar, was transferred to the position of Production Accountant and Assessor and his duties were taken over by the Senior Production Engineer, R. W. Edgecombe, pending consolidation of several field offices which will eliminate the position.

Consolidation of smaller field offices which are close together was commenced during the year. The Stettler office was closed and most of the combined Red Deer-Stettler area is covered from Red Deer, with small portions of the area assigned to nearer offices. Planning for the consolidation of Devon, Redwater and Camrose into a single office at Edmonton was started during the year. These consolidations are made possible by better roads and communications and more automatic control equipment in the field. The major result will be a reduction in the number of engineers required and a slight reduction in overall complement, and more effective staff utilization. The latter will be achieved through a replacement of some engineers by field technicians.

The staff at each field office consists of an engineer in charge, an assistant engineer in the larger offices, and a number of technicians. The staff at the smallest office consists of 1 engineer and 2 technicians, while the proposed

Edmonton office will be staffed by 4 engineers and 18 technicians. As of December 31, 1964, the total field staff consisted of 11 engineers (including the Northern District Engineer), 37 technicians and 8 stenographers.

Activities During the Year

The field offices have continued to emphasize production records checks during the year. Less attention was paid to well testing, although much attention was given to economic allowance entitlement testing. More time was given to thorough study of company production records to ensure good production practices.

The amount of time spent checking surface conditions of producing and abandoned wells declined slightly since the Surface Reclamation Council now inspects all well sites in surveyed territory. All well installations are still checked by Board staff to ensure that well head equipment conforms with the Drilling and Production Regulations, and well sites in unsurveyed territory are checked by the Board for surface clean-up and well head equipment.

Approximately 650 of the 2,450 production batteries in the Province were inspected in 1964. These inspections are made to check the adequacy of equipment used, to ascertain if the proper distances between installations are maintained and to ensure that operating procedures are satisfactory. Due to consolidation of smaller batteries into larger automatic batteries, the total number of batteries did not increase significantly during the year.

Inspections of gas meters to verify measurement accuracy covered about 70 per cent of the total meters installed. This percentage varied from area to area, but was never less than that required to ensure satisfactory metering operations.

Drilling rig inspection procedures emphasize the Board's concern that strict control be maintained over potential producing horizons at all times. As a consequence, maintenance of blowout prevention and allied equipment is closely watched. Over 700 formal inspections were made during 1964, and in the majority of these, good drilling practices were found to be the rule. In addition, 2,000 more or less informal rig visits were made, including over 500 visits to service rigs. A steady improvement in the quality of rig operations has been noted since this inspection program commenced several years ago.

B OIL DEPARTMENT

Responsibilities and Functions

The Oil Department is concerned with matters affecting conservation and correlative rights in oil production operations. It is responsible for analysis and surveillance of enhanced recovery operations, assessment of reserves and productive capacity, oil well spacing, oil sand experimental schemes and technical matters relating to the proration plan.

The functions of the Oil Department are primarily of a reservoir engineering nature and more specifically are:

(1) to determine ultimate oil reserves, reserves growth trends and maximum permissive rates of oil production,

(2) to review the production performance of all oil pools and recovery schemes therein, and recommend to the Board means of improving conservation in certain pools,

(3) to advise the Board concerning orders and approvals for enhanced recovery schemes and oil sands experimental schemes, oil well spacing, and advise other departments concerning salt water disposal and production measurement,

(4) to co-ordinate and maintain records of bottom hole pressure surveys of oil pools in the Province,

(5) to initiate Board orders designating fields and pools, and to advise the Economic Studies Department in the preparation of monthly production allowable orders.

Organization and Staff

The Oil Department includes fourteen engineers (one assigned to the Special Studies Department), eleven technical-clerical assistants, one stenographer and one typist. The engineering staff is divided into the Reserves Division, responsible for evaluation of maximum permissive rates, reserves and well spacing; the Projects Division, responsible for evaluation and surveillance of enhanced recovery operations; and the Oil Sands Division, responsible for oil sands. The clerical-technical processing group is responsible for providing assistance to each engineering division, for the

processing of routine data and the conduct of routine Board administrative practices. The staff complement at December 31, 1964, was as follows:

Manager, N. A. Strom	1
Chief Engineer, G. A. Warne	1
Senior Engineers, J. A. Bray, R. G. Evans, H. J. Webber	3
Other Engineers (including one in Special Studies and Programming)	9
Engineering Assistants and Clerks	11
Stenographer and Typist	<u>2</u>
Total	27

Activities During the Year

The Oil Department dealt with 305 registered applications in 1964 (as compared with 223 in 1963) of which 98 resulted in public hearings. Of the total number of applications considered, 65 per cent related to matters of enhanced recovery and well spacing. The balance pertained to maximum permissive rates (MPRs) in pools and portions of pools subject to different recovery mechanisms, oil sands schemes, salt water disposal schemes, units, concurrent depletion, and gas measurement exemption. The registered proceedings which resulted in hearings on MPRs involved consideration of nearly 200 separate submissions. Board orders and approvals drafted by the Oil Department totalled almost 400.

The Department completed reserve evaluations for over 100 pools of a total of 366 designated oil pools in the

Province. Pool performance records for 284 oil pools were maintained from which pool performance charts for 119 pools were prepared. The Oil Department participated in processing 750 new core analyses, and in reprocessing 1100 old core analyses. About 3200 bottom hole pressure measurements, 1200 fluid level measurements and 1200 calibrations were processed. Some 150 separate studies of reservoir rock and fluid properties were completed using data from oil base cores, special core analyses and PVT analyses.

Relative to the annual reserves assessment and in connection with MPR submissions, the Reserves Division made detailed reservoir engineering studies of fifteen pools. For example, ultimate reserves of the Bonnie Glen D-3 Pool were re-evaluated based upon up-to-date interpretations of geology, reservoir factors, interface advance and material balance. Waterflood recovery from the Pembina Cardium Pool, which has been subject to widely differing interpretations in industry, was assessed employing a 300-well model of the pool. Approximately 100 other pools were studied on a routine basis because of significantly altered interpretations of one or more of such factors as rock volume, water saturation, porosity or reservoir fluid characteristics.

The petrophysics engineer, an addition to the Reserves Division in 1964, completed important studies of residual oil saturation for the Pembina Cardium Pool and concerning relative permeability curves and residual oil

saturation generally applicable for D-2, D-3 and Rundle pools. He also played an important role in the computerized study of the Redwater D-3 pool referred to under the Special Studies and Programming Department.

Regarding the new proration plan, pool performance projections were developed, and, forms and procedures were drafted for the annual reserves hearing. Also considerable consultation was conducted in response to a wide variety of questions relating to the new proration plan and the institution of production spacing units.

A Board hearing was held in November, 1964, respecting the Board's method of establishing maximum rate limits in the interests of conservation. Also considered at this hearing was a submission prepared by the Reserves Division regarding gas penalty policy.

The Projects Division processed 130 applications concerning enhanced recovery operations. Approximately three-quarters of these were for additions to approved schemes or for initiation of schemes similar to those already operating in a pool. As a rule, these required only routine confirmation of well injectivity and pattern coverage needs, in addition to analysis of recovery improvement. The remaining applications required somewhat more consideration because of the scheme being the initial one in a pool, covering a significant portion of a pool, or involving an unusual enhanced recovery process.

A comprehensive study and report to the Board concerning expected oil well abandonments over the next ten year period and the feasibilities of casing recovery and tertiary recovery in pools affected was completed by the Projects Division. A variety of matters relating to conformance with the terms of Board approvals were brought forward resulting in corrective actions in a few cases.

The Oil Sands Division, manned by one engineer, devoted considerable time toward familiarization with all existing experimental schemes and assisted in the consideration of applications and approvals for oil sands experimental schemes.

The clerical-technical processing group, in addition to its variety of routine duties, carried out much of the calculations relevant to the new proration plan. It prepared the first integrated province-wide survey of bottom hole pressure measurements to be conducted during 1965.

C . GAS DEPARTMENT

Responsibilities and Functions

The Gas Department is concerned with the conservation of gas and related products, including propane, butanes, pentanes plus, and sulphur. In addition, the department is responsible for the determination of the reserves and deliverability of gas, natural gas liquids, and sulphur, and for assessing the availability of gas to meet requirements of the various utility systems in the Province.

Specifically the department has the following functions:

- (1) to calculate reserves in all pools in the Province of gas, propane, butanes, pentanes plus, condensate, and sulphur; to assist the Board in assessing gas export applications;
- (2) to establish permissible rates of production for certain gas wells, determine frequency of gas well tests and prescribe methods of testing wells and calculating flow potentials;
- (3) to review the production performance of all gas pools;
- (4) to carry out studies with regard to the establishment of conservation projects, both surface and sub-surface;
- (5) to review the performance of gas processing facilities, and review at regular intervals, the requirements for and availability of gas to the smaller gas utility systems;
- (6) to review applications to construct major pipelines, and advise the Alberta Department of Mines and Minerals in this regard; and
- (7) to determine the deliverability of gas produced from fields connected or expected to be connected to intraprovincial and extraprovincial markets. These studies are made at such times that applications for removal of gas from the Province are considered by the Board.

Organization and Staff

The department is primarily technical in nature, and is headed by the Manager. The assistant administrative head, the Chief Gas Engineer, is responsible for the day to day operations of the department. A section head, the Reserves Engineer, oversees and co-ordinates the evaluation of reserves.

The staff complement as of December 31, 1964, is as follows:

Manager, Gas Department, N. J. Lashuk	1
Chief Gas Engineer, G. J. DeSorcy	1
Other Engineers	6
Engineering Assistants	6
Stenographer	<u>1</u>
Total	15

Activities During the Year

During 1964, the department participated in some twenty-five to thirty public hearings. A discussion of some of the more significant ones follows:

(1) Alberta and Southern Gas Co. Ltd. and Trans-Canada Pipe Lines Limited applied for an increase in the amount of gas that each may remove from the Province. The Department made extensive studies to determine the reserves of gas, the deliverability of the reserves to meet future provincial requirements as well as the volumes now authorized and those requested, and the reserves surplus to these requirements.

(2) The British American Oil Company Limited and Provo Gas Producers Limited requested authority to remove small volumes of gas from the Antelope, Esther and Wildunn Creek Fields.

(3) A hearing to consider the need for continuing annual allowables in the Medicine Hat Field was held during the year.

(4) On request from the Gas Utilities Board, staff of the department filed a submission with the Gas Utilities Board respecting an application by Northwestern Utilities, Limited concerning the production of gas in the Fort Saskatchewan Field.

(5) For the annual gas allowable hearing the department made reservoir studies on ten fields to determine values for all factors used in the calculation of average or maximum daily rates of gas production.

(6) Applications to cycle portions of the Carstairs Field and the Crossfield Field were considered at public hearings.

In addition to the studies made for the major hearings, the department investigated the economics of conserving oilfield gas in a number of fields, the feasibility of cycling several gas fields, the suitability of processing schemes in a number of fields, such as Wimborne and Edson, the efficacy of cycling schemes presently in operation, plus a number of smaller projects.

The department, in conjunction with the Geology Department, made studies to determine the reserves of gas in some 450 pools, and reviewed previous estimates for a further 100 pools.

In addition to the preparation of 103 reservoir performance charts, the department prepared for the first time charts showing the recoveries of products at 30 gas processing plants.

The department continued studies with respect to the report on The Theory and Practice of The Testing of Gas Wells, a discussion draft of which was published early in 1964.

The engineering assistants continued their regular work of checking gas well test reports and calculations, preparing draft orders, calculating well allowables, planimetering reserve maps, and gathering data.

D GEOLOGICAL DEPARTMENT

Responsibilities and Functions

The Geological Department is responsible for the preservation and evaluation of certain well data, the administration of the Board's well evaluation requirements, the mapping of reserves and the preparation of subsurface geological maps. This department also performs special investigations, related to these responsibilities, to assist other Board departments and the Alberta Department of Mines and Minerals. The Drafting Section of the

Geological Department is responsible for the preparation of all maps, charts and graphs, and all general drafting for Board departments.

The main functions of the department are:

(1) to administer the coring, logging, drill stem testing and drill cutting requirements of the Board and to collect and store logs and drill stem test charts;

(2) to receive, process and provide examination facilities for drill cuttings and core at the Core Storage Center;

(3) to evaluate hydrocarbon-bearing intervals at all productive wells and prepare maps to delineate the area and volume of each pool;

(4) to identify, record and publish the names and depths of the stratigraphic markers penetrated by all wells drilled;

(5) to provide geological assistance to other Board departments and to the Department of Mines and Minerals;

(6) to maintain geological, cross-sections, well location and status maps for sale and internal use; and

(7) to conduct general drafting for Board orders, publications, reports, lectures and addresses.

Organization and Staff

The Chief Geologist is the head of the Department as well as being Chief Geologist of the Alberta Department of Mines and Minerals. He and his assistant spend part of

their time supervising or conducting special projects in addition to their administrative duties. Within the Geological Department there are three distinct groups. The staff complement of the department is shown below:

Chief Geologist, J. R. Pow	1	
Assistant Chief Geologist, L. A. Falkenberg	<u>1</u>	2
<u>Geological Group</u>		
Evaluation Geologist	1	
District Geologists	3	
Regional Geologist	1	
Geologists	5	
Geological Assistant	1	
Stenographer and Clerks	<u>3</u>	14
<u>Core Storage Center</u>		
Supervisor	1	
Assistant Supervisor, Core Handlers and Laboratory Assistants	8	
Receptionist - Typist	<u>1</u>	10
<u>Drafting Section</u>		
Chief Draftsman	1	
Draftsmen	<u>5</u>	<u>6</u>
Total		32

Within the Geological Group, the Evaluation Geologist is responsible for evaluation studies. He is assisted by District Geologists who are responsible for their

respective districts. The District Geologist coordinates reserve mapping, marker determinations, special investigations and supervises the geologists who are assigned to his district. In addition to the foregoing complement, one geologist works on regional projects.

Activities During the Year

(1) Geological Department

Stratigraphic markers were identified, recorded and published for about 1,800 wells. Hydrocarbon-bearing zones were evaluated for some 1,100 productive wells drilled during the year and the reserve maps were prepared or revised as required. In addition, some twenty active and inactive fields were re-evaluated on the basis of new evidence.

During the past year, the Geological Department investigated certain geological aspects of the application of the computer to reservoir studies.

Approximately 100 operators' submissions or applications were investigated with respect to pay thickness, acre or acre-footage factors, areal definition of a pool or continuity of a newly discovered pay zone with previously discovered reserves.

Eight detailed maps showing contours on the base of the Fish Scale horizon were prepared. These eight maps completed a set of ten, all of which were published during 1964.

At the request of the Department of Mines and Minerals, 600 P. & N. G. leases were evaluated for Crown reserve sales, 200 P. & N. G. reservation reports were reviewed and 25 applications for gas lease credit were processed. In addition, 65 zone designations were prepared and particulars submitted on 20 wells with offset drilling obligations.

Log and core analysis depths were aligned for 1,700 backlog wells in preparation for data processing.

Miscellaneous activities included the classification of over 1,800 wells, determination of casing requirements for 70 water supply wells, collection of stabilized water levels for 400 wells, investigation of near-surface gas blow-outs for areas where test hole applications were received and examination of 100 abandonment applications.

(2) Core Storage Center

During 1964, Industry and a number of scientific groups expressed concern regarding the previously-endorsed program for slabbing and destroying residual core and selected field core. Following discussions, the Board adopted a new program to indefinitely store all full-diameter core in good condition. On the Board's recommendation, the Provincial Government agreed to increase its share in the costs of operating the Core Storage Center by providing funds to build the new extension necessary to implement the revised program.

Approximately 30,000 boxes of current and backlog core were accepted at the Center. In addition some 208,000 cuts of drill cuttings were washed and prepared for examination. In all cases duplicate drill cuts were prepared for the Geological Survey of Canada.

(3) Drafting Section

The drafting of illustrations for published Board reports and the preparation of base maps for areas of oil field development accounted for a large part of the section's work load. A number of older maps were re-drafted or revised and eight geological maps were drafted for sale. Slides were prepared for illustrations in technical papers presented by the Board's staff. The Department investigated applications of the computer for plotting information.

E SPECIAL STUDIES AND PROGRAMMING DEPARTMENT

Responsibilities and Functions

The Special Studies and Programming Department's responsibilities pertain primarily to program development for computer applications, and special studies having complex or computer oriented solutions.

The main functions of the department are:

- (1) To undertake special studies as directed.
- (2) To analyse and appraise computer applications.
- (3) To conduct closed shop computer programming.
- (4) To assist open shop programmers.
- (5) To provide solutions to special problems arising from computer operations.

(6) To advise the Board on computer technology.

Additional responsibilities are associated with familiarization of staff with operational programs and maintenance of computer programs.

Organization and Staff

As department head, the Special Studies Engineer directs all departmental functions. A division of staff responsibilities along specialized techniques is not maintained and various personnel are assigned to specific undertakings as required.

The department's staff complement at December 31, 1964, consisted of:

Special Studies Engineer, E. Stoian	1
Staff Engineer	1
Engineer, Special Studies	1
Engineer - Programmer	1
Programmer	1
Stenographer	<u>1</u>
Total	6

Activities During the Year

Early in the year, a study was conducted to determine the dependence of the pool performance factor used in the subsisting proration plan, upon rate and cumulative production. An evaluation of multi-regression analyses was submitted to the Board for consideration.

A study initiated late in 1963 to evaluate both

theoretical and empirical methods of predicting the specific gravity of separator gas was completed with the assistance of seconded staff from the Gas Department. A comprehensive review was presented for consideration by industry at the 1964 Calgary Spring Meeting of the Canadian Institute of Mining and Metallurgy.

A study required to predict well productivities in water drive oil pools progressed satisfactorily. At year end, supporting data had been prepared and final methods for solution proposed. A review of pertinent literature continued throughout the year.

Although a gas recovery study, commenced in 1963, has been temporarily discontinued, several preliminary recommendations have been usefully implemented.

During 1964, a pilot study was completed for the Redwater field for the purpose of evaluating modern computer techniques applicable to oil-in-place and recovery determinations. The project was co-ordinated by the Special Studies Engineer and completed in co-operation with all departments. Preparations for formal presentation to the Board have been finalized.

A continued review of data storage and retrieval systems extended throughout the year.

Of sixteen computer programs finalized in closed-shop operation, four were utility programs and twelve related to reservoir engineering and proration. Typical

programs performed: (a) calculations of water influx for various reservoir-aquifer geometries and flow conditions, (b) determinations of dimensionless factors describing water and gas coning, (c) calculations of gas-oil and water-oil relative permeabilities of reservoir rocks by theoretical and empirical relationships, (d) determinations of recoverable oil or gas by volumetric methods, and (e) simulations of proration of oil to market demand.

The department assisted in the effective use of data processing equipment by program modifications and data preparation simplifications.

In co-operation with all departments, a preliminary but extensive review of functions, procedures and work volumes was completed for delineating the organization's needs for integrated data processing and computer equipment.

A plan of introducing newly developed computer programs by informal workshop sessions was started during the year. In addition, active computer programs have been reviewed with interested staff.

Several computer programming courses were held for staff commencing work in the department.

F CHEMICAL LABORATORY

Responsibilities and Functions

The laboratory, located in the Engineering Building at the University of Alberta in Edmonton, is generally

responsible for the analysis of formation fluids which are representative of the various formations in the fields and pools in Alberta, for the processing of analyses and samples from the operators engaged in production or exploration, and for issuing information about analyses. This department also performs any special investigation of a chemical nature which is related to production, disposal, or pressure maintenance, as the need arises. By arrangement with the University, certain facilities are made available to the University, and the Chief Chemist provides a limited amount of assistance in connection with research projects of both the University and the Research Council of Alberta.

Organization and Staff

The department is generally technical in nature although a considerable amount of clerical work is done. All operations are supervised by the Chief Chemist. Routine analyses are handled by trained technicians.

The permanent staff complement as of December 31, 1964 is as follows:

Chief Chemist, D. R. Shaw	1
Technicians	2
Typists	<u>2</u>
Total	5

Activities During the Year

The analysis of 460 samples occupied the majority

of the working time of the laboratory technicians. A total of 2000 additional analyses carried out on Alberta oil, gas and formation water by others were filed with the laboratory. The information from all analyses was standardized on cards which are used for general reference and in preparation of publications.

G ECONOMIC STUDIES DEPARTMENT

Responsibilities and Functions

The Economic Studies Department is responsible for preparation of the monthly oil proration order, for statistical compilations and for economic analyses.

The main functions of the Economic Studies Department are:

- (1) in co-operation with the Oil and Gas Departments, to forecast demand and supply for liquid hydrocarbons, sulphur, and particularly for natural gas in the Province of Alberta;
- (2) to prepare a five-year forecast of oil industry operations relative to the Board's activity to serve as the basis for the Board's annual five year expenditure and revenue forecast;
- (3) to carry out special studies regarding the economic aspects of conservation;
- (4) in co-operation with the Oil Department, carry out monthly proration computations; and
- (5) to compile statistical information covering

all aspects of the oil and gas industry, and the comparative position of oil and gas in the total energy picture.

Organization and Staff

The Department is headed by the Chief Economist, D. P. Saca. The staff complement at December 31, 1964, was at its full strength of five, comprising the Chief Economist, an economist, a senior and a junior statistical clerk and one stenographer.

Activities during the year

Other than its routine activities, the Department participated extensively in special studies arising out of applications to and hearings before the Board on oil proration and gas export

H ACCOUNTING DEPARTMENT

The Accounting Department's responsibilities are carried out under two separate divisions, financial and production accounting. The Chief Accountant, K. W. Fuller, is the head of the department.

Financial Accounting Division

Responsibilities and Functions

The Financial Accounting Division is responsible for all general accounting, budget preparation and collection of the Board's annual levy.

The major functions of the division are:

(1) to process all expenditures, receive all revenues and maintain all necessary records;

(2) to finalize the accounting records as at March 31, each year and co-operate with a representative of the Provincial Auditor on his annual audit;

(3) to prepare, in co-operation with the other departments, the budget for Board approval for the next fiscal year and prepare a five year forecast of expenditure and revenue;

(4) to provide the Board with monthly statements comparing budgeted and actual expenditure and revenue, to assist in the maintenance of control over expenditure and to establish current financial policy;

(5) to assist, in co-operation with the Assistant Assessor, in the collection and follow-up of outstanding tax accounts;

(6) to maintain records necessary to the control of all inventorial assets of the Board, to supervise the annual physical check of inventory items, and to notify the Board of any discrepancies.

Organization and Staff

The Financial Accountant is the head of the division and is responsible to the Chief Accountant. In December, 1964 the Production Accountant was appointed Assessor and the assessment section was transferred from Financial to Production Accounting. The financial accounting section will continue to co-operate in the collection and follow-up of outstanding taxes. As of December 31, 1964, the approved complement was as follows:

Financial Accountant, W. P. Williams	1
Clerks	4
Typist and Bookkeeping Machine Operator	<u>2</u>
Total	7

Activities During the Year

During 1964, the general accounting functions embracing payroll, revenue, expenditures, inventory and budget procedures were routine. The assessment section assessed over 8,000 oil and gas properties to some 30,000 working and royalty ownership interests and issued 1,000 tax notices. For the 1964 Assessment year, the Board revised the statutes to eliminate from taxation all oil and gas properties with an assessed value of less than \$3,000.00. This revision significantly reduced the number of tax notices issued without significantly affecting tax revenue.

At year-end, with the appointment of Mr. M. R. Blackadar, as Production Accountant and Assessor, the assessment section is being re-organized to report directly to the Assessor.

Production Accounting Division

Responsibilities and Functions

The Production Accounting Division is responsible for the receipt and processing of production and disposition reports, and the preparation of detailed and summary information for use by the Board, industry and other agencies.

During 1964, its responsibilities were increased by the addition of the Assessment Section which formerly was considered a part of Financial Accounting.

The major functions of the division are:

(1) to collect from industry the well production data and well and plant disposition required under The Oil and Gas Conservation Act;

(2) to ensure that the reporting forms in use properly request the desired information and are revised to meet changing requirements; and to co-operate with other provincial and federal agencies in the use of comparable forms, and in the avoidance of duplication of original data where possible;

(3) to examine the reports received to ensure that regulatory requirements are met by the operator and, with the assistance of data processing equipment, to prepare detailed and summary records for Board use;

(4) to check the reported oil, gas and water production against assigned allowables, and notify operators of the over or under status for each of their wells, and

(5) to prepare the assessment roll, to issue assessment notices, process appeals, calculate the mill rate, issue tax notices and assist in the collection of the tax levy.

Organization and Staff

The Production Accountant and Assessor is the head of the division and is responsible to the Chief Accountant.

In December, 1964, M. R. Blackadar, formerly Southern District Engineer was appointed to this position. The Assistant Production Accountant's position was filled in July with the appointment of T. H. Ashton. The three sections under his supervision are Production Records, Allowables and Publications and Statistics. The Assistant Assessor, A. E. F. North is responsible for the supervision of the Assessment Section.

As of December 31, 1964, the staff complement is as shown in the following table:

Production Accountant, M. R. Blackadar	1
Assistant Production Accountant	1
Assistant Assessor	1
Clerks	14
Stenographer	1
Machine Operator	<u>1</u>
Total	19

Activities During the Year

Approximately 80,000 reports covering the production and disposition of oil, gas and water were processed during the year. In addition to the processing of incoming reports, the Publications Section contributed to the following publications issued by the Board:

Weekly Drilling Report

Monthly Statistics

Annual Statistics

Cumulative Annual Statistics

Well Production Information Services

Pool Production Record

New amendments to the General Regulations which became effective on December 1, empowered the Board to hold inquiries for wells which have been consecutively over produced for nine months, and clarifies the procedures to be followed in assessing penalties for the seventh, eighth and ninth months.

I ADMINISTRATIVE SERVICES

A wide variety of administrative services functions are performed in the Board by three departments, namely Office Services, Personnel and Tabulating. Their duties, staff and activities are described below:

Office Services Department

Responsibilities and Functions

The Department is responsible for purchasing, printing and mailing, control of well records and central filing, building requirements and services, and switchboard and reception duties.

The major functions are as follows:

(1) to attend to space, service and insurance requirements of all Board buildings;

(2) to maintain a purchasing and stock control program;

(3) to observe and control motor vehicle operating costs;

(4) to print or arrange for commercial printing of letters, orders, forms, reports, publications, maps, amendments to Acts, Regulations and the Index to Board Order Book; to maintain address plates for subscription and mail lists and for various initial forms for new wells;

(5) to attend to all mailing functions and manage all files other than departmental files; to serve public requests for information from filed documents;

(6) to provide hearing reporter and library services; and

(7) to maintain drilling records for all wells drilled.

Organization and Staff

The department is headed by the Office Services Supervisor. There are three sections in the Department, namely Purchasing, Reproduction and Records, and each is headed by a supervisor. The staff complement is as follows:

Office Services Supervisor, J. G. Anderson	1
Section Supervisors	3
Clerks	17
Machine Operators	6
Receptionists, Switchboard Operator, Typists and Stenographer	<u>7</u>
Total	34

Activities During the Year

A Records Centre was established for the supplying

of information to industry representatives. All information, other than core and sample information, was made available at the Centre together with Reproduction facilities. This consolidation provided more efficient access to data for both industry and the Board staff by eliminating the previous system of having to visit various Departments for different types of information.

An innovation was the usage of microfilming to record Well Record Cards, Analyses, Back Pressure Tests and Production. This information, on a well basis, is placed on one microfolio and a duplicate of the microfolio or a print of any image can be supplied.

A review of the operation of the Board's library resulted in its reorganization. In addition, a trained librarian, Mrs. J. Hicks was employed and the library placed in more attractive quarters. These improvements have brought a continuing increase in use of the library by the Board and its staff.

General level of activity in all sections remained constant. During the year, approximately 840 orders and approvals were issued, 175,000 items of outgoing mail were handled and some 1,750 purchase orders were issued.

Personnel Department

Responsibilities and Functions

The Personnel Department has the responsibility of assisting in the acquisition and maintenance of a competent staff for the Board, and ensuring that the Board's

policies relating to personnel practices and procedures are carried out.

The principal functions are:

(1) to recruit new staff in co-operation with other departments;

(2) to administer programs of employee evaluation, staff education and employee benefits;

(3) to administer the salary policy and conduct surveys of salary rates, and

(4) with the assistance of the other departments, to prepare the annual salary budget for the next year, record variances during the year and control overtime expenditures.

Organization and Staff

The department is headed by the Personnel Officer, R. C. J. Webber and is assisted by a Clerk and a Typist.

Activities During the Year

During the year the Personnel Officer, M. Boldt, resigned in order to further his education. He was replaced by R. C. J. Webber.

A major salary survey was carried out by the Department in which consideration was given to salary ranges paid by industry and by the Provincial and Federal Governments. This assisted the Board in its annual review of staff salaries.

Several Personnel Administration policies were revised during the year and at present the Department is

assisting in formulating a supervisory training program.

Tabulating Department

Responsibilities and Functions

The Tabulating Department is responsible for processing all data received to obtain either, monthly and yearly statistics, or intermediate statistics for use in special studies.

The Department's main functions are:

- (1) to encode data into machine language;
- (2) to process encoded data, as required, through either the "LGP 30" or the "Univac 1004" systems;
- (3) to design systems and programs for the "Univac 1004" system.

Organization and Staff

The Department is headed by the Tabulating Supervisor. The staff complement as at December 31, 1964 was as follows:

Tabulating Supervisor, H. G. Blackburn	1
Assistant Tabulating Supervisor	1
Machine Operators	<u>9</u>
Total	11

Activities During the Year

The daily running time on the LGP 30 was increased to a shift and a half. This necessitated the hiring of an additional operator to handle the increased work load and achieve better turn-around times.

The encoding of Core Analyses Reports was completed with all reports edited to ensure their accuracy.

The work handled by the Univac 1004 was processed on improved schedules as the staff became more familiar with its operation.

VI EXPENDITURE AND REVENUE

The Board's fiscal year end is March 31, but since all other sections of this report relate to the calendar year, the Board has decided to ignore the three month difference and treat expenditures and revenues relating to the fiscal year April 1, 1964, to March 31, 1965, as applying to the 1964 calendar year. Financial data for previous years are applied in a similar manner.

Table 1 provides a summary and comparison of expenditures and revenue for the years 1960 - 1964 inclusive. The Board's net expenditure represents the sum of salary, general operating and capital expenditure less collections from the sale of publications and information. The cost of capital acquisitions are charged in full against revenues in the year of purchase. Revenue of the Board is received through the levy of a tax upon the assessed value of all oil and gas properties liable to assessment and by a grant from the Provincial Government.

During the last five years the Board's net expenditure has increased by an average annual rate of 3.8 per cent. Net expenditure during 1964 was \$1,762,000, an increase of \$43,000, or 2.5 per cent over the previous year. Salaries increased by \$42,000 or 3.0 per cent to \$1,457,000, while general operating expenses increased by \$10,000 or 2.2 per cent to \$459,000. Capital expenditure was reduced by \$3,000 to \$44,000 and collections increased by \$6,000 or 3.1 per cent to \$198,000.

The 3 per cent increase in salary costs during 1964 was

below the five year average of 5.8 per cent. This reduced rate of increase is a result of staff reductions largely due to consolidation of the Stettler and Red Deer field offices and to the difficulty in replacing staff after a fairly high turnover.

Table 2 gives a comparison of Board expenditures in terms of wells capable of production, industry production revenue and equivalent barrels of production.* Industry production revenue represents the total sales value of crude oil, natural gas and products f.o.b. well or plant. In 1964 the value of crude oil sales represented 70 per cent of the total production revenue as compared to over 80 per cent in 1963.

The cost of operating the Board in terms of a capable well has decreased from \$127 in 1960 to \$115 in 1964. A review of these costs over a longer period indicates that Board expenditure per capable well increased steadily until 1957 when it reached \$136 and has been declining since that date. Board expenditures per equivalent barrel of production revenue have decreased from 1.0 cents to 0.70 cents over the period 1960 to 1964. Efficient utilization of personnel and the acquisition of electronic data processing equipment, both permitting a reduction in the rate of staff increase, are

* Equivalent Barrels = $\frac{\text{total industry production revenue}}{\text{weighted average price per barrel of oil.}}$

largely responsible for the reduction in unit costs.

In 1964, as in previous years, the Provincial Government provided the funds necessary to meet approximately 47 per cent of the Board's net expenditures. This amounted to some \$831,000.00 and represented the Provincial Government direct grant of \$705,000.00 to meet 40 per cent of the net expenditure and an additional \$126,000.00 being the Government's share of the Board's tax levy. The remainder of the tax levy charged to all other owners of oil and gas properties assessed amounted to \$931,000.00 in 1964, an increase of \$15,000.00 over the previous year.

The assessed value of oil and gas properties subject to assessment in 1964 was \$1,412,000,000. resulting in a mill rate of .75 mills to raise the portion of Board revenue met by taxation.

TABLE 1

OIL AND GAS CONSERVATION BOARD

Comparative Statement of Expenditure and Revenue

For the Five Years 1960 - 1964

(000's Dollars)

	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>
Expenditure					
Salaries	\$ 1,192	\$ 1,305	\$ 1,388	\$ 1,415	\$ 1,457
General Operating					
Building rent, utilities	101	98	142	178	182
Printing, office supplies	69	75	78	88	89
Travelling, automobile	81	67	67	58	60
Machine rental and repairs	51	51	45	58	56
Telephone	19	20	21	20	19
Lab. & Field supplies	11	12	13	12	18
Miscellaneous	33	41	41	35	35
Total	<u>365</u>	<u>364</u>	<u>407</u>	<u>449</u>	<u>459</u>
Capital	59	53	57	47	44
Total	\$ 1,616	\$ 1,722	\$ 1,852	\$ 1,911	\$ 1,960
Collections	106	151	174	192	198
Net Expenditure	\$ 1,510	\$ 1,571	\$ 1,678	\$ 1,719	\$ 1,762
Revenue					
Industry Share of tax*	\$ 807	\$ 841	\$ 905	\$ 916	\$ 931
Provincial Government					
Share of tax*	99	102	102	115	126
Appropriation	604	628	671	688	705
Total Revenue	\$ 1,510	\$ 1,571	\$ 1,678	\$ 1,719	\$ 1,762
Percent of Increase in Net Expenditure over Previous Year	5.9	4.0	6.8	2.4	2.5

* Actual tax levy adjusted for surplus.

TABLE 2

OIL AND GAS CONSERVATION BOARDComparison of Board Net ExpenditurePer Capable Well and Industry Production Revenue

	<u>Total Capable Wells</u>	<u>Total Board Staff</u>	<u>Industry Production Revenue(000)</u>	<u>* Annual Production Equivalent Barrels(000)</u>	<u>No. of Capable Wells per Staff Member</u>	<u>Board Net Expenditure</u>	
						<u>Per Capable Well(Dollars)</u>	<u>Per Equivalent Barrel(Cents)</u>
1960	11,884	240	\$ 362,400	150,373	49	127	1.00
1961	12,752	241	452,400	191,695	52	123	.82
1962	13,366	253	544,700	215,296	53	125	.78
1963	14,287	247	600,500	238,282	58	120	.72
1964	15,215	246	641,500	248,643	62	115	.70

- 67 -

* Equivalent Barrels = $\frac{\text{Total industry production revenue}}{\text{Weighted average price per barrel of oil.}}$

VII PUBLICATIONS AND ADDRESSES

The Board makes available to industry and the general public a wide variety of publications and maps. The policy adopted in 1963 with regard to the pricing of these services was continued and is based on the principle that those costs associated with each publication which are over and above normal operating costs must be met by revenue generated from its sale.

The following new publications and maps were issued in 1964:

Publications

Gas Plant Performance Charts

This publication is similar in style to the Reservoir Performance Charts and provides volume and other details for each plant.

Licence to Drill New Well (Daily list of applications)

Formerly complimentary, these listings were placed on subscription basis in January, 1964. Subscribers may either obtain their listing(s) directly from the Board offices or receive them by mail.

Pressure-depth and Temperature-depth Relationships Alberta Crude Oil Pools

This publication provides interpretation of these relationships in the form of tables and graphs.

Sub-surface pressure data

Formerly complimentary, this data is now issued quarterly on a subscription basis.

Theory and Practice of the Testing of Gas Wells

This manual was issued early in 1964 in draft form. Operators were requested, wherever possible, to use the testing principles outlined and to forward any suggested improvements to the Board. A revised edition will be issued in 1965.

New Maps

Structure Contours on Base of Fish Scales

A new series of maps was initiated and maps were issued during the year for Areas 1, 2, 4, 5, 6, 8, 9, 10, 11 and Northern Alberta.

Isobaric Contour

A series of maps was issued for 25 pools. The demand for these maps was not sufficient to warrant the issuing of any further maps and the publication was discontinued.

In addition to the above the Board continued to issue the following regular publications during the year:

Statistical Publications

Weekly Drilling Report - Alberta Oil and Gas Industry

Monthly Statistics - Alberta Oil and Gas Industry
(Annual Statistics - December issue)

Cumulative Annual Statistics

Well Production Information Service (issued quarterly)

Pool Production Record (issued quarterly)

Technical Publications

Fluid Analyses - Alberta Oil and Gas Industry (issued quarterly)

Schedule of Wells Drilled for Oil and Gas in 1963.

Reservoir Performance Charts

Oil Pools to December 31, 1963

Oil Pools to June 30, 1964

Gas Pools to December 31, 1963

Gas Pools to June 30, 1964

Units and Conservation Schemes of the Province of Alberta -
December 31, 1963.

Reservoirs of Gas, Natural Gas Liquids, Crude Oil and
Sulphur of the Province of Alberta, December 31, 1963.

Technical Publications

Well and Pool MPR Factors - Second Amendment

Miscellaneous Publications

Index of Board Orders (issued monthly)

Production Accounting Handbook (amended when necessary)

Report of the Operations of The Oil and Gas Conservation Board, 1963.

The following special reports resulted from major public hearings:

OGCB 64-1 Report to the Lieutenant Governor in Council with respect to the Application under The Gas Resources Preservation Act, 1956, of Trans-Canada Pipe Lines Limited - February, 1964.

OGCB 64-3 Report to the Lieutenant Governor in Council with respect to the Application under Part VIA of The Oil and Gas Conservation Act, of Great Canadian Oil Sands Limited - February, 1964.

OGCB 64-10 Report and Decision on Review of Plan for Proration of Oil to Market Demand in Alberta - July, 1964.

OGCB 64-11 Report to the Lieutenant Governor in Council with respect to the Applications of Trans-Canada Pipe Lines Limited and Alberta and Southern Gas Co. Ltd. under The Gas Resources Preservation Act, 1956 - November, 1964.

The following addresses and technical papers were presented
by members of the Board and its staff in 1964:

<u>Speaker</u>	<u>Title of Address</u>
G. W. Govier	"Avoiding Technical Obsolescence" Canadian Natural Gas Processing Association Calgary, February 27, 1964.
	and to the Canadian Standards Association Oil and Gas Pipeline Code Committee, April 20, 1964.
G. W. Govier	"Meaning and Background of Alberta's New Proration Plan" C.I.M.M. and C.I.M.-A.I.M.E. Edmonton Section Edmonton, September 16, 1964.
G. W. Govier	"Engineering Economics and Conservation" C.I.M.-A.I.M.E. Calgary Petroleum Engineering Section, April 15, 1964.
	and to the Interstate Oil Compact Commission, Biloxi, Mississippi, December 10, 1964.
G. W. Govier	"Developments in the Athabasca Oil Sands" Southern Alberta Institute of Technology and Art, Calgary, October 14, 1964.
Vernon Millard	"New Plan for Proration to the Market Demand in Alberta" Petroleum Industry Training Service Banff School of Fine Arts Banff, November 24, 1964.
L. A. Bellows	"Board's Regulations and Inspections" as they pertain to safety. Workmen's Compensation Board Inspectors Edmonton, July 10, 1964.
L. E. Hicklin	"Gas Reserve Estimates" Canadian Gas Association, Third Annual Measurement School, June 4, 1964.
L. J. Schneider	"Oil and Gas in Alberta" Grade 6 Class of Redwater School, June, 1964.

<u>Speaker</u>	<u>Title of Address</u>
S. Vavra	"Drilling Regulations" Valleyview Safety Clinic March, 1964.
R. H. King	"Acquisition by the Board of Drilling Information and Data" Oilfield Scouting Association Calgary, March, 1964.
R. H. King	"Assessment and Taxation by the Oil and Gas Conservation Board" Petroleum Tax Society Calgary, November, 1964.
G. J. DeSorcy	"The Compressibility of Natural Gas" The Canadian Gas Association June 4, 1964.
K. W. Fuller	"Oil and Gas Statistics and Board Reporting Forms" Petroleum Industry Training Service Production Accounting Course Edmonton, March, 1964
	and to the
	Canadian Association of Petroleum Production Accounting, Calgary, February, 1964.
V. F. Jones	"General History of Board and its Relationship to Industry plus Brief History of Oil Industry" Devon High School Devon, October 2, 1964.
D. A. Nikiforuk	"Oil and Gas Conservation Board Policies and Objectives" Toastmasters Club, Medicine Hat, October 7, 1964.
E. Stoian	"Introduction to Digital Computers" Alberta Society of Engineering Technicians, Calgary Regional Meeting, January, 1964.
E. Stoian	"Theoretical Calculation and Empirical Evaluation of the Specific Gravity of Separator Gas" Annual Technical Meeting of the Petroleum Natural Gas Division of the Canadian Institute of Mining and Metallurgy, Calgary, May, 1964.

<u>Speaker</u>	<u>Title of Address</u>
N. A. Strom	"Alberta's New Proration Plan" Oilfield Technical Society October 29, 1964, and to the Petroleum Industry Buyers Group, September 17, 1964, and to the Engineering Institute of Canada, November 23, 1964
G. A. Warne	"The New Proration Plan" Edmonton Association of Petroleum Landmen November 10, 1964, and to the Desk and Derrick Club Edmonton, October 21, 1964 and to the Association of Professional Engineers, Red Deer, October 7, 1964
H. J. Webber	"The Development of the Athabasca Oil Sands" P. S. Warren Geological Society University of Alberta, Edmonton December 10, 1964.

<u>Author</u>	<u>Title of Technical Paper</u>
G. W. Govier and R. A. Ritter of the University of Alberta, Edmonton, Alberta	"Pipeline Flow Characteristics of Crude Oil" Division Paper of the Engineering Institute of Canada, Vol. 6, No. E, December 4, 1963.
A. G. Morrison (In collaboration with C. C. Bombardieri, Imperial Oil Limited)	"Chemical Tracers Pinpoint Communication in Multiple Wells" World Oil, January, 1964.

